

Single risk factor interventions to promote physical activity among patients with chronic diseases

Systematic review

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ABSTRACT

OBJECTIVE To provide a summary of evidence on the effectiveness of interventions to promote physical activity among patients affected by at least 1 chronic disease. The interventions studied were each targeted at a single risk factor.

DATA SOURCES MEDLINE, CINAHL, and EMBASE were searched from 1966 to 2006 using 2 sets of search terms. First we searched using *physical activity* or *physical fitness* or *exercise* and *health care* or *primary care* or *primary health care* or *family practice* or *medical office* or *physician's office* and *health promotion* or *health education* or *counselling*. Then we used *physical activity* or *exercise* and *diabetes* or *hyperlipidemia* or *hypertension* or *obesity* or *cardiovascular disease* or *pulmonary disease* or *risk factor* or *comorbidity* and *health promotion* or *health education* or *counselling* or *prescription*.

STUDY SELECTION We chose randomized controlled trials or trials with a controlled quasi-experimental design that evaluated single risk factor interventions to promote physical activity among adult patients in primary care settings who were affected by at least 1 chronic disease, that reported participation in physical activity as a primary outcome, and that were published in English or French.

SYNTHESIS Of the 4858 articles found, 62 were assessed, and 3 were selected. Two studies concluded that the interventions evaluated had no effect on level of physical activity. The other reported a positive short-term effect with use of an intensive intervention that was based on the theory of planned behaviour and integrated nurses into the general practitioner counseling process.

CONCLUSION There is insufficient evidence to assess the effectiveness of single risk factor interventions to promote physical activity among patients affected by at least 1 chronic disease in primary care settings. Of 3 studies, only 1 reported a short-term positive effect.

EDITOR'S KEY POINTS

- Good evidence supports the use of physical activity in the prevention and treatment of chronic diseases, but how can we get our patients moving? The authors of this systematic review assessed the literature to determine which interventions were effective in promoting physical activity among those with chronic diseases.
- Most studies analyzed programs targeting multiple behaviours; there were only a few studies that looked at single factor interventions in those with chronic diseases, and the results of these were conflicting.
- So how do we get our patients with chronic diseases moving? We still don't know.

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Interventions portant sur un seul facteur de risque pour promouvoir l'activité physique chez des patients atteints de maladies chroniques

Revue systématique

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RÉSUMÉ

OBJECTIF Rassembler les données concernant l'efficacité des interventions visant la promotion de l'activité physique chez des patients souffrant d'au moins une maladie chronique. Chacune des interventions étudiées portait sur un seul facteur de risque.

SOURCES DES DONNÉES On a consulté MEDLINE, CINAHL et EMBASE entre 1966 et 2006 à l'aide de 2 jeux de mots clés. Une première recherche utilisait les rubriques *physical activity* ou *physical fitness* ou *exercise* et *health care* ou *primary care* ou *primary health care* ou *family practice* ou *medical office* ou *physician's office* et *health promotion* ou *health education* ou *counselling*. Une deuxième, les rubriques *physical activity* ou *exercise* et *diabetes* ou *hyperlipidemia* ou *hypertension* ou *obesity* ou *cardiovascular disease* ou *pulmonary disease* ou *risk factor* ou *comorbidity* et *health promotion* ou *health education* ou *counselling* ou *prescription*.

CHOIX DES ÉTUDES Nous avons retenu les essais randomisés ou ceux ayant un plan quasi-expérimental avec témoins qui évaluaient des interventions de promotion de l'activité physique chez des adultes souffrant d'au moins une maladie chronique et qui ciblaient un seul facteur de risque dans un contexte de soins primaires, qui avaient comme principale issue la participation à l'activité physique et qui étaient rédigées en anglais ou en français.

SYNTHÈSE Sur les 4858 articles retracés, 62 ont été évalués et 3 ont été retenus. Deux études concluaient que les interventions étudiées n'avaient aucun effet sur le niveau d'activité physique. L'autre, dans lequel des infirmières cliniciennes participaient à la dispensation de conseils avec l'omnipraticien, rapportait un effet à court terme d'une intervention intensive fondée sur la théorie du comportement planifié.

CONCLUSION Il n'y a pas suffisamment de données pour évaluer l'efficacité des interventions de promotion de l'activité physique qui ciblent un seul facteur de risque auprès de patients atteints d'au moins 1 maladie chronique, dans un contexte de soins primaires. Sur 3 études, une seule rapportait un effet positif de courte durée.

POINTS DE REPÈRE DU RÉDACTEUR

- L'utilité de l'activité physique pour prévenir et traiter les maladies chroniques repose sur des preuves solides, mais comment réussir à faire bouger nos patients? Les auteurs de cette revue systématique ont recensé la littérature pour déterminer quelles interventions étaient les plus efficaces pour promouvoir l'activité physique chez ceux souffrant de maladies chroniques.
- La plupart des études retenues portaient sur des programmes visant plusieurs comportements; seulement quelques études portaient sur un seul type d'intervention chez des sujets atteints de maladies chroniques, et leurs résultats sont contradictoires.
- Alors comment amener nos patients souffrant de maladies chroniques à bouger? Nous l'ignorons toujours.

Cet article a fait l'objet d'une révision par des pairs.
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Chronic medical conditions are an important focus for the development of strategies aimed at improving population health worldwide.¹ A great deal of literature supports the beneficial effects of physical activity in preventing²⁻⁷ or alleviating chronic diseases^{3,8-21} and in increasing psychological well-being and reducing stress, anxiety, and feelings associated with depression.^{2,22-24} Physical activity can also decrease pain,^{2,25} increase the resistance and vigour of those affected by chronic diseases,^{2,3} and decrease patients' risk of developing functional impairment.^{8,13}

About 60% of people around the world and more than 50% of American adults do not get the minimum amount of physical activity recommended by the American College of Sports Medicine and the United States Centers for Disease Control and Prevention, which is 30 minutes of moderate activity at least 5 days a week.²⁶⁻²⁸ About 25% of adults are completely sedentary.²⁸ Physical activity tends to decrease with age^{26,28} and is less prevalent²⁸ among those affected by functional limitations or chronic diseases.^{8,29,30}

Considering the many preventive and curative effects of physical activity, primary care professionals should get involved in promoting it among patients affected by chronic diseases.^{3,8} Patients frequently identify their family physicians as an important source of encouragement for physical activity.^{31,32} There is a debate in the literature, however, about the effectiveness of counseling patients on physical activity in primary care. The latest recommendations of the United States Preventive Services Task Force have concluded that there are insufficient convincing data at the moment to make a statement in favour of or against counseling to promote physical activity in primary care.³³ This conclusion was based mainly on the lack of demonstrated steady effect, perhaps owing to the fact that most studies described interventions of limited duration. We looked at 11 critical reviews of studies evaluating interventions to promote physical activity among general primary care patients. Four of these reviews concluded that there was not enough evidence to say that such interventions were effective,³⁴⁻³⁷ while 7 reported that interventions were effective.³⁸⁻⁴⁴ Patients with chronic diseases might be more receptive to counseling than patients in the general population are. It might be effective to develop targeted counseling for patients with chronic diseases because they often have barriers to activity, such as functional limitations.^{31,45} If they do have such barriers, their needs for counseling could well differ from those of the general population.

The purpose of this review was to provide an update on and comprehensive summary of evidence on the effectiveness of single risk factor interventions to promote physical activity among patients affected by at least 1 chronic disease in primary care settings.

DATA SOURCES

We searched MEDLINE (1966 to 2006), CINAHL (1982 to 2006), and EMBASE (1980 to 2006) for articles published in English or French. To be as exhaustive as possible, we searched all terms as key words. Our first search included the following key words: *physical activity* or *physical fitness* or *exercise* and *health care* or *primary care* or *primary health care* or *family practice* or *medical office* or *physician's office* and *health promotion* or *health education* or *counselling*. To ensure that we identified all studies on interventions to promote activity among patients with chronic diseases for which physical activity is encouraged, our second search included the terms *physical activity* or *exercise* and *diabetes* or *hyperlipidemia* or *hypertension* or *obesity* or *cardiovascular disease* or *pulmonary disease* or *risk factor* or *comorbidity* and *health promotion* or *health education* or *counselling* or *prescription*. We also examined other relevant studies from the reference lists of the articles collected and of previous reviews in this field (hand searching).

Study selection

The first author (C.H.) did the initial screening. Any ambiguous findings were discussed with the second author (M.F.) until consensus was reached.

Inclusion and exclusion criteria. Studies meeting the following criteria were included in this review:

- randomized controlled trials or trials with a controlled quasi-experimental design;
- trials evaluating single risk factor interventions to promote physical activity (interventions targeting only physical activity rather than programs targeting multiple behaviour changes);
- trials conducted with adults (≥ 18 years) recruited from primary care settings and affected by at least 1 chronic disease;
- trials reporting participation in activity as a primary outcome; and
- trials published in English or French.

We excluded studies involving only geriatric patients (≥ 65 years) because those patients could differ substantially

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*Figure 1 is available at www.cfp.ca. Go to the full text of this article on-line, then click on CFPlus in the menu at the top right-hand side of the page.

from younger patients (more functional limitations, dementia, etc) and require specific types of counseling.

Selection process. Figure 1* shows the number of articles found at each stage of the selection process. The searches identified 4858 studies. Abstracts were read in order to select articles based on our inclusion criteria. In all, 62 studies were read completely and evaluated. Finally, we assessed the quality of the 3 studies that met our inclusion criteria: Little et al,⁴⁶ Marshall et al,⁴⁷ and van Sluijs et al.⁴⁸

SYNTHESIS

Assessing the quality of the studies

The quality of each article selected was assessed critically before the article was included in this systematic

review. We developed a scale based on the CONSORT statement,⁴⁹ in which points were assigned for study parameters that indicated good quality. Using this scale, 2 researchers (C.H. and M.F.) independently determined a global quality score for each article (Table 1⁴⁶⁻⁴⁸). The scores were then compared and adjusted by consensus. To ensure adequate methodologic quality, the cutoff score for an article to be included in the synthesis was set arbitrarily at 14 out of a maximum 28 points. The 3 studies' scores ranged from 20 to 22 (Table 1⁴⁶⁻⁴⁸).

Description of the studies

Table 2⁴⁶⁻⁴⁸ presents a comparison of the 3 studies. In the study by Little et al,⁴⁶ the 151 participants had hypertension, hyperlipidemia, a body mass index greater than 25, or diabetes. Marshall et al⁴⁷ recruited 329 participants with hypertension and 438 without hypertension. The 358 participants in the study by van Sluijs et al⁴⁸ had

Table 1. Criteria for evaluating the 3 studies identified in the literature search: 0, 1, 2, 3, or 4 points per criterion were awarded for a possible maximum score of 28.

POSSIBLE POINTS	CRITERIA	DESCRIPTION	STUDIES		
			LITTLE ET AL ⁴⁶	MARSHALL ET AL ⁴⁷	VAN SLUIJS ET AL ⁴⁸
0 to 2	1. Participants	Precise inclusion criteria for participants as well as settings and locations where data were collected	2	1	2
	2. Interventions	Precise details of the interventions intended for each group and how they were actually administered	1	2	2
	3. Sample size	Description of how sample size was determined and, when applicable, explanation of any interim analyses and stopping rules	2	0	0
	4. Randomization	Description of the method used to generate and implement the random allocation sequence including details of any restrictions (eg, blocking, stratification)	2	0	2
	5. Statistical methods	Explanation of statistical methods used to compare groups for primary outcomes	2	2	2
	6. Results	Description of flow of participants through each stage and of protocol deviations from study as planned, along with reasons	1	2	2
	7. Baseline data	Description of baseline demographic and clinical characteristics of each group	2	1	1
	8. Numbers analyzed	Precise number of participants (denominator) in each group included in each analysis and whether the analysis was by intention-to-treat	2	2	2
	9. Outcomes and estimates	Summary of results for each group for primary outcomes and precise description of estimated effect size	1	2	2
	10. Discussion	Comprehensive discussion of interpretation of results, taking into account study hypotheses and sources of potential bias or inaccuracy through discussion of limitations that affected findings	1	2	2
0 to 4	11. Generalizability	Generalizability (external validity) of trial findings	2	3	2
	12. Overall evidence	General interpretation of results in the context of current evidence	2	3	3
TOTAL			20	20	22

hypertension, hypercholesterolemia, or type 2 diabetes. None of the studies described comorbidities.

Little et al⁴⁶ evaluated all combinations of 3 interventions: general practitioners' prescription of brisk exercise not requiring a leisure facility (eg, walking) for 30 minutes per day 5 days a week; counseling by practice nurses based on a psychological theory to modify intentions and perceived control of behaviour (theory of planned behaviour) and using behavioural therapy implementation techniques; and distribution of the Health Education Authority booklet *Getting Active, Feeling Fit*. After 1 month, level of physical activity was evaluated using Godin's questionnaire.^{50,51} In the study by Marshall et al,⁴⁷ patients recruited into the risk factor intervention group received material and medical advice encouraging them to be more active and to manage their hypertension better. The advice and prescription were supplemented with a self-help booklet. Level of physical activity was measured using the International Physical Activity Questionnaire⁵² at 2 and 6 months. In the study by van Sluijs et al, the intervention consisted of advice about becoming more active and an 8-week follow-up including visits with the health care provider and 2 booster telephone calls from a counselor in physical activity. Counseling was based on stage-of-change theory and the level of activity was evaluated using the Short Questionnaire to Assess Health-enhancing Physical Activity⁵³ at 8 weeks and at 6 and 12 months.

Results of the studies

Details of the analysis and results are shown in **Table 2**.⁴⁶⁻⁴⁸ All studies had excellent follow-up response rates and used intention-to-treat analysis. Little et al⁴⁶ showed a positive trend from the least intensive intervention (usual care) to the more intensive interventions (prescription by a general practitioner and counseling by a nurse) toward increased physical activity at 1 month. In the 2 other studies, no significant effect of the interventions was observed on level of physical activity over time. In the study by van Sluijs et al,⁴⁸ the study population as a whole exhibited a significant increase in physical activity at 1 year.

DISCUSSION

Our systematic review of articles on single risk factor interventions to promote physical activity among patients affected by at least 1 chronic disease in primary care settings had seemingly conflicting results. Two studies concluded that the interventions evaluated had no effect on levels of physical activity, while the other reported a positive short-term effect using a somewhat intensive intervention.

The 3 studies in our review differed with respect to the instruments used to quantify physical activity and

the nature and intensity of interventions. The studies used different validated questionnaires (Godin's questionnaire,^{50,51} the International Physical Activity Questionnaire,⁵² and the Short Questionnaire to Assess Health-enhancing Physical Activity⁵³). To assess the level of activity more accurately, objective measuring devices, such as pedometers or accelerometers, could be used along with the questionnaires. As to the nature and intensity of interventions, we observed that Little et al,⁴⁶ who measured a short-term (1 month) effect, evaluated an intervention that went beyond simple counseling by a general practitioner to integrate other health professionals and psychological techniques aimed at changing patients' behaviour. The study by van Sluijs et al,⁴⁸ however, also used these interventions without demonstrating a short- or long-term effect. In that study,⁴⁸ contact with a counselor was only by telephone. Perhaps face-to-face counseling would have been more effective. These 2 studies were also based on different behavioural theories; the first on the theory of planned behaviour and the other on stage-of-change theory. Godin et al have argued that level of physical activity would be measured better by a model taking into account, not in sequence but simultaneously, both intention to engage in activity in the near future and recent past participation in activity.^{50,51} The different nature and intensity of interventions in the 3 studies might partly explain their different results. Studies evaluating more intensive interventions are needed.

Critical reviews of studies evaluating interventions to promote physical activity among more general primary care populations also had varying results. Four reviews reported there was not enough evidence to conclude that the interventions were effective³⁴⁻³⁷; 7 had more positive results.^{38-43,54} Variation in the nature and intensity of interventions in these studies might explain the differences in results here also. Most of the authors agreed on the need for further high-quality research. Interestingly, 2 reviews that reported positive effects concluded that studies in which interventions were tailored to participants' characteristics or that considered behaviour change strategies were effective.^{41,42}

The article by van Sluijs et al⁴⁸ reported that the study population as a whole had significantly increased their level of physical activity at 1-year follow up. As discussed in the article, increases in activity levels among control groups have often been observed in randomized controlled trials promoting physical activity.^{48,55-57} The authors proposed some explanations for this finding. First, they assessed whether there was a measurement effect. By comparing a group measured in 4 ways with a group measured in 2 ways at 6-month follow-up, they were able to demonstrate a positive measurement effect on level of activity. This might explain the observed increase in activity levels among control subjects. Second, the Hawthorne effect, which is the tendency

Table 2. Comparison of the 3 studies of single risk factor interventions to promote physical activity among patients with chronic diseases in primary care

CHARACTERISTICS	LITTLE ET AL, ⁴⁶ 2004 (N = 151)	MARSHALL ET AL, ⁴⁷ 2005 (N = 767)	VAN SLUIJS ET AL, ⁴⁸ 2005 (N = 358)
Country	England	Australia	The Netherlands
Design	Randomized controlled trial	Cluster randomized controlled trial	Cluster randomized controlled trial
Setting or practitioners	4 settings: deprived inner city, rural small town, market town, cathedral city	75 GPs	29 practices
Population	Patients ≥ 18 y with hypertension, hyperlipidemia, BMI > 25, or diabetes	Patients 40–70 y with (n = 329) and without (n = 438) hypertension	Patients 18–70 y with hypertension, hypercholesterolemia, or type 2 diabetes
Recruitment	Invitation letters	During routine visits	Invitation letters and leaflets
Intervention	<p>8 groups: no intervention, a single intervention, or any combination of the 3 interventions. Counseling was based on the theory of planned behaviour. The 3 interventions were as follows:</p> <ul style="list-style-type: none"> • a doctor's prescription for brisk exercise not requiring a leisure facility (eg, walking) 30 min/d, 5 d/wk; • counseling by practice nurses based on a psychological theory to modify intentions and perceived control of behaviour and using behavioural implementation techniques; and • use of the Health Education Authority booklet <i>Getting Active, Feeling Fit</i> 	<p>4 groups: health promotion intervention, health promotion control, risk factor (hypertension) intervention, risk factor (hypertension) control. The strategy was similar in the 2 intervention groups; the focus of the advice was different. Patients in the health promotion group received material and advice encouraging them to be more active. Patients in the risk factor intervention group received material and advice encouraging them to be more active and to manage their hypertension better. The advice and prescription for physical activity were supplemented with self-help booklets. Distribution of booklets was guided by stage of motivation and readiness for physical activity and behavioural support strategies</p>	<p>All patients received advice on becoming more active from GPs or NPs during 10-min consultations at baseline. The intervention comprised 2 visits with providers and 2 booster telephone calls. At the first visit, patients filled out stage-assessment forms and forms for 1 of 3 counseling protocols. Protocols contained stage-specific information and questions that patients answered before the next visit. A physical activity counselor called patients 2 wk after the initial visit to provide encouragement and resolve problems. Follow-up consultations took place 4 wk after initial visits; final telephone calls followed 8 wk later. In the control group, providers briefly questioned patients about current levels of activity and, when appropriate, encouraged them to become more active</p>
Primary outcome	Level of physical activity assessed at 1 mo using Godin's questionnaire	Level of physical activity assessed at 2 and 6 mo using the short form of the International Physical Activity Questionnaire	Level of physical activity assessed at 8 wk and 6 and 12 mo by the Short Questionnaire to Assess Health-enhancing Physical Activity
Analysis	Nonparametric test for trend	Bivariate cluster-adjusted analyses to compare the differences between groups with the generalized estimating equation accounting for the correlated structure within practices	Linear regression analyses, multilevel model (timing of follow-up, the individual, and the general practice) adjusted for confounders. Follow-up measurements were defined as dependant variables; baseline values of dependant variables were included as covariates. Regression coefficients for group allocation variables reflected average differences in outcome variables over time. Multilevel modeling (individual and general practice) was also used to assess changes within the study population from baseline to 1-y follow-up
Results	Follow-up response rate was 82%. There was a trend from the least intensive (control with or without booklet) to the most intensive (prescription and counseling with or without booklet) interventions. There was significant increase in physical activity from baseline (Godin's score 14.4, 95% CI 7.8–21; test for trend, $P = .02$) only with the most intensive intervention. Combining exercise prescription and counseling explicitly based on psychological theory likely led to important increases in physical activity	Follow-up response rates were 92% and 84% at the 2- and 6-mo assessments. Neither intervention strategy resulted in significant changes in self-reported physical activity regardless of whether the advice was tailored to hypertension management or consisted of general health promotion information	Follow-up response rates were 94%, 89%, and 86% at the 8-wk and 6- and 12-mo assessments. No significant effect of the intervention over time was observed on level of physical activity, but the study population as a whole exhibited a significant increase in physical activity at 1-year follow up (mean increase 61.6 min, 95% CI 7.5–115.6 min)

BMI—body mass index, CI—confidence interval, NP—nurse practitioner.

of people who are singled out for special attention to perform better merely because of the expectations created by the situation,⁵⁸ might have contributed to this increase as well. Third, general practitioners in the control arm might have offered more advice on activity to their patients than is usually the case. This study stresses the challenges of doing randomized controlled trials on promoting physical activity and the importance of taking biases, such as the Hawthorne and measurement effects as well as contamination, into account in designing studies and interpreting results.


Further research is needed to identify which kinds of interventions could be effective over the long term among chronically ill patients. Collaborative nurse-physician practices might be good settings in which to develop such interventions. In addition to patients with chronic conditions related to cardiovascular disease, future studies could include patients with other problems such as osteoarthritis or asthma.

Limitations

The main limitation of a systematic review is its inability to include all the relevant literature and all the unpublished material on the subject. We realize that some articles could have been missed during our searches, even though our search strategy using all the terms as key words favoured a more exhaustive literature review. Our hand search was another way to help us identify additional relevant articles. Restricting the search to articles published in French or English was also a limitation.

Other interventions could have been used to promote physical activity among these primary care patients within a framework of programs targeting other behaviour (eg, smoking, reducing weight). As a preliminary step, we preferred to focus only on single risk factor interventions to document their isolated effect because trying to change behaviour in several areas at the same time might have made a difference to each behaviour change.

Conclusion

There are insufficient data at this time to assess the effectiveness of single risk factor interventions to promote physical activity among patients affected by at least 1 chronic disease in primary care. We reviewed 3 studies: 2 concluded that the interventions had no effect on level of activity, while the other reported a short-term positive effect. The intervention deemed effective was based on the theory of planned behaviour and integrated physician-nurse counseling. Further research is needed to identify which kinds of interventions would be effective over the long term among chronically ill patients. 

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Contributors

Dr Hudon conceived the study, performed the initial literature search, and wrote the first version of the article. She discussed any ambiguous findings with **Dr Fortin**. **Drs Hudon and Fortin** read the 3 articles and determined a global quality score for each. **Dr Fortin and Dr Soubhi** reviewed the results, commented on the study's findings, and contributed to the revisions of successive drafts of the manuscript. All the authors approved the final version of the paper submitted.

Competing interests

None declared

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